Contract Number: W9132T-04-C-0018

Offeror: IdaTech, LLC

IdaTech 2003 PEM Demonstration Program in Rappahannock, VA with Fort AP Hill/Rappahannock Electric Cooperative

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

Locations
Fort AP Hill, Administration Building, Rappahannock, Virginia

July 7, 2004

Executive Summary

The offeror and manufacturer, IdaTech, will conduct a demonstration of one PEM fuel cell system at Fort AP Hill in Rappahannock, VA with subcontractor Rappahannock Electric Cooperative (REC). The Fort AP Hill system will use propane fuel, operate off-grid, and be located outdoor. The system will be rated at 4.6 kW AC output and will not operate in CHP mode.

The energy generated from the demonstration is estimate to be approximately 15,768 kWh of electricity assuming that the fuel cell system operates at an average output of 2.0 kW for 90% of a full year.

The point of contact at Fort AP Hill is Brian Robinson, 804-633-8262, 18436 4th St., Fort AP Hill, VA 22427, brian_1_robinson@belvoir.army.mil.

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1.0 Descriptive Title

IdaTech 2003 PEM Demonstration Program in Omaha, Nebraska with Fort AP Hill/Rappahannock Electric Cooperative.

2.0 Name, Address and Related Company Information

Name: IdaTech, LLC (IdaTech)
Address: 63160 Britta St., Bend, OR 97701
Phone: 541-383-3390
Fax: 541-383-3439
DUNS Number: 95-789-2193 CAGE Code: 1M0T9
TIN: 93-1202376

Located in Bend, Oregon, IdaTech is a world-class energy technology company focused on the development and commercialization of fuel processor technology and integrated Proton Exchange Membrane (PEM) fuel cell solutions. Founded in 1996, IdaTech has developed some of the most compact and efficient fuel processors and fuel cell systems operating on a variety of common fuels, including natural gas, propane, methanol, and low-sulfur liquid hydrocarbons. Additionally, IdaTech continues integrating its fuel processor technology with the best available fuel cell power modules to develop power systems from 1 to 50 kilowatts for a wide range of portable and stationary applications. These systems are being demonstrated, evaluated, and field-tested in various applications with business partners in North America, Europe, and Japan. IdaTech currently employs approximately 65 people.

3.0 Production Capability of the Manufacturer

As described in Section 2.0 above, IdaTech is a world-class developer and manufacturer of fuel cell systems and fuel cell components including fuel processors and fuel cell stacks and is fully capable of supplying the required components for the proposed systems. IdaTech manufactured approximately 25 fully integrated fuel cell systems in 2003. IdaTech's philosophy towards manufacturing volume and demonstrations is orderly development. In practice, this means IdaTech manufactures enough systems to statistically validate technology advances and then places a limited number of those systems in the field to further validate the technology. This discipline ensures that IdaTech engineers are able to advance development goals rather than continuously support prototype demonstrations. IdaTech has selected this CERL opportunity due to its outstanding opportunity to display high performance in a well-publicized forum to a key target market.

In support of the field demonstration IdaTech will provide support through 40 hours of on-site field installation services and 30 hours of training services that will be provided with the delivery of the fuel cell system. Site preparation including an appropriate pad, plumbing potable water, electrical interconnection with load including transfer switch if needed and any required security and landscaping are the responsibility of the host site and partner utility. Site remediation is also outside the scope of the fuel cell manufacture and will be provided by the host site and utility partner.

IdaTech contact information is detailed in Section 2.0 above.

4.0 Principal Investigator(s)

Bill A. Pledger
Senior Vice President & Chief Engineer
IdaTech, LLC
Phone: 541-322-1025
Fax: 541-383-3439
E-Mail: bpledger@idatech.com

Education
1982: B.S. in Chemical Engineering, Oregon State University, Corvallis, Oregon
Professional Accreditation
1977: Professional Engineer in State of Oregon
Professional Highlights
1996-Present: Senior Vice President, Chief Engineer, IdaTech, LLC. Directs design, development and testing of fuel cell systems and major subsystems. Areas of expertise include metallic membranes, membrane reactors, membrane module design and construction, chemical process equipment and process modeling.
1994-1996: Chief Engineer, Micromonitors, Inc., Bend, Oregon. Responsible for field-testing and evaluation of microelectronic, electrical transformer fault gas analyzers.
1992-1994: Senior Engineer, Bend Research, Inc., Bend, Oregon. Responsible for design and construction of membrane-based systems and pilot plants. Areas of expertise include process modeling and electronic system design and construction.
1985-1992: Research Engineer, Bend Research.

Bill Pledger can be reached through the contact information listed in section 2.0 above.

5.0 Authorized Negotiator(s)

Name: Hal Koyama
Title: Vice President of sales and Marketing
Company: IdaTech, LLC
Phone: 541-322-1000
Fax: 541-383-3439
Email: hkoyama@idatech.com

6.0 Past Relevant Performance Information

IdaTech has been successful developing systems and solutions that specifically address a customer's or development partner's business problem. The following is a list of recent examples:

1. Scaleable power solution for The U.S. Army Communications – Electronics Command (CECOM). CECOM contracted with IdaTech to develop a 2 kW fuel cell system to power an array of communications and other electronic equipment on a High Mobility Multipurpose Wheeled Vehicle (HMMWV - pronounced Hum-Vee).
   Customer: US Army – CECOM
   Contact: Nicholas Sifer – FC Program Manager
   Phone and/or e-mail: 703-704-0272 / Nicholas_Sifer@beml01.belvoir.army.mil
   Contract #: DAAB0798DH502/0039
   Dollar Value: ~US$ 226,000

2. Hybrid power solution combining fuel cells with photovoltaics – IdaTech and Electricite de France (EDF) jointly integrated a fuel cell system with photovoltaic (PV) technology in a hybrid power system for remote locations.
   Customer: Electricite de France
   Contact: Thierry Brincourt
   Phone and/or e-mail: 33 1 60 73 71 01 / thierry.brincourt@edf.fr
   Contract #: F 57992/0
   Dollar Value: ~US$ 455,000

3. Propane fueled fuel cell system for telecommunication applications – Working under two funding grants from the Propane Education and Research Council (PERC), IdaTech proved its' capabilities related to fuel processing and system integration for propane fueled fuel cell systems.
   Customer: Propane Education and Research Council (PERC)
   Contact: Larry Osgood
   Phone and/or e-mail: 719-487-0080 / LDOgood1@aol.com
   Contract #: Docket No's 10229 & 10857
   Dollar Value: ~US$ 742,000

4. Natural gas fuel cell system for German Utility – Over a three month period, IdaTech worked closely with a German Utility for the design and development of a fully integrated natural gas fuel cell system for a multi-family building. IdaTech leveraged its modular design philosophy and took existing building blocks (fuel cell module, fuel processor module, power electronics, etc.) to have a system ready for factory acceptance testing within 60 days from time of contract.
   Customer: German Utility
   Contact: N/A (due to NDA)
   Phone and/or e-mail: N/A (Due to NDA)
   Contract #: 6560
   Dollar Value: ~US$ 203,000

7.0 Host Facility Information

Fort AP Hill is a U.S. Army installation near Bowling Green, VA, located 20 miles southeast of Fredericksburg, VA. The installation is named in honor of Lieutenant General Ambrose Powell Hill, a Virginia native who distinguished himself as a Confederate commander during the Civil War. The fort was first established as an Army training and mobilization area in 1941. It was an important staging area during World War II, where

more than 75 percent of the North African invasion force was trained and equipped. Today, the post's 75,944 acres make it the sixth largest military installation on the East Coast. Fort AP Hill is used for training by more than 150,000 Active military, National Guard, and U.S. Army Reserve soldiers annually. It truly is one of the nation's premier all-purpose, year-round, field training destinations with nearly 76,000 acres, including a 27,000-acre live fire complex. The National Scout Jamboree location is staged near the center of Fort A.P. Hill.

Fort AP Hill will be acting as a Project Partner and Site Owner to IdaTech. As the Site Owner, Fort AP Hill will be responsible for identifying the site and gaining necessary approvals to site the fuel cell systems with the command of the base. Additionally, Fort AP Hill personnel will be involved in operational training and participate in the installation and maintenance activities as required. Brian Robinson is authorized to act on behalf of A.P. Hill during the proposal development, site selection process, contract negotiations, and installation/operation of the fuel cell system. Brian is the acting Director of Public Works. Contact Information: 804-633-8262 or via e-mail at brian_l_robinson@belvoir.army.mil.

Rappahannock Electric Cooperative (REC) is the electricity provider to FT AP Hill, a consumer owned utility which provides electric service to more than 80,000 connections in parts of 16 Virginia counties. It was formed in 1980 with the merger of two cooperatives, Virginia Electric Cooperative in Bowling Green and Northern Piedmont Electric Cooperative in Culpepper. The cooperative's General Offices are in Spotsylvania County. REC maintains over 10,000 miles of power lines through its service area, which ranges from the Blue Ridge Mountains to the mouth of the Rappahannock River. REC serves a variety of residential, commercial, and industrial accounts. On August 1, 2002, REC officially became responsible for approximately 200 miles of electric distribution lines at Fort AP Hill. This transfer was the result of more than four years of work between REC, AP Hill, the U.S. Army Corps of Engineers, Baltimore District, and the Military District of Washington Acquisition Center at Fort Belvoir.

Figure 2. Front Gate at Fort AP Hill

8.0 Fuel Cell Site Information

Site 2: Fort AP Hill with Rappahannock Electric Cooperative in Caroline County, VA

The system that will be sited at Fort AP Hill will be a propane etaGen 5 fuel cell system that will be running outside, off grid and will continuously power 2 kW AC of security lighting. The system will be located at the Administrative Support Building.

The etaGen 5 PEM fuel cell system contains five process flow connections. They are: a 6" galvanized duct for the system exhaust, a ½" NPTM fuel inlet, and a 3/8" Tube "Push-Connect" for the De-ionized water inlet. An external multi-stage water treatment system will be supplied with this system. There are also some electrical connections for power and remote monitoring.

The ancillary equipment that will be included in this system will be: a DC/AC inverter designed to take the DC voltage from the fuel cell and change it to 120/240V AC output, absorbed glass mat lead acid Batteries in a 120V/26amp hour bank, fuel clean up module for sulfur removal, a water purification system that has been designed with knowledge of local water quality, a rugged outdoor enclosure to withstand the elements, a heater designed to keep the system from freezing, and a radiator system for heat dissipation.

Figure 4. The IdaTech fuel cell system will be located on the north side of the Administration Building at Fort AH Hill.

The planned operating procedure for the system is to provide power for some security lighting that should amount to 1.5 to 2kW_e. This will serve as the systems base load. The fuel consumption at base load conditions should be approximately 6 slpm of propane

(@25°C) and 40ml/min of water. The system is capable of producing a maximum output of 4.6kW$_e$, and will ramp up as necessary to match an increase in the load. The fuel consumption at maximum output is approximately 12slm of propane (@25°C) and 80ml/min of water. The system is designed for unmanned operation unless the system calls for outside intervention. The run data from the system will be retrieved by IdaTech.

Combustion exhaust and other gases are exhausted from the fuel cell system through an exhaust duct located at the back of the system enclosure. These gases must be vented to the outdoors through an exhaust ducting system. The exhaust ducting system includes a fan that must be installed in the exhaust duct.

9.0 Electrical System

The fuel cell system will have a continuous output rating of 4.6 kW AC at 120/240 volts. The fuel cell system will be operated at 2.0 kW AC electrical output and will be used to power security lighting. The system will be operated exclusively in Grid-Independent mode and will provide only AC output.

The system will be interconnected to the host site using a sub-panel and automatic transfer switch (ATS). The sub panel will be used to break out circuit from the grid connected source, and instead power those circuits using the fuel cell system. An ATS will be installed that will be capable of transferring the sub-panel circuits back to grid power if the fuel cell system goes off-line for any reason.

10.0 Thermal Recovery System

No thermal recovery was proposed.

11.0 Data Acquisition System

The data acquisition system will be a National Instruments Field Point measurement and control system. The data is recorded as a text file in the system and is downloaded by IdaTech. The major parameters being monitored by the system are various reactor and fuel cell temperatures and pressures that are pertinent to control and safety. The fuel and water flow rates are monitored as well as the power output of the system. If any one of these parameters, or others that are monitored by the system, displays an out of range value it will cause a system fault.

All faults cause the fuel cell system to shut down. Upon sensing a fault condition, the Fault indicator will illuminate, and the fuel cell system will automatically transition to the Shutdown state and then to Standby after the shut down process has completed. The shut down process requires approximately 5 minutes. During the shut down process, the Fault indicator will remain illuminated.

After reaching the Standby state, the Fault indicator will remain illuminated. All faults must be acknowledged and cleared by the user before the fuel cell system can be restarted. From the Standby state, the fuel cell system may be restarted, or disconnected from the electric power source by opening the all-pole switch or disconnecting the plug and socket.

Due to security issues, IdaTech may not be able to connect to a high speed data line at any of the sites. This will require the use of a dial-up connect and a periodic download of large data files to a laptop or CD that will need to be transferred from a location off-base.

12.0 Economic Analysis

Total energy savings is to be calculated using the formula:

Total energy savings = (electric energy and demand savings) + (thermal recovery savings) - (input fuel cost).

For this project demand charges are not considered and there is no heat recovery so energy savings would be a simplified calculation that subtracts the cost of the fuel from the value of the electricity.

The electric provider for the Ft AP Hill site will be Rappahannock Electric Cooperative and the approximate electric rate is 2.0 cents per kWh. The propane for the project will be supplied by Revere Propane at an approximate cost of $1.35 per gallon, or approximately $1.48 per therm.

Value of Electricity:

- 2 cents per kWh
- 2 kW continuous output
- Planning 7,884 hours of operation for demonstration.

0.020 * 2 * 7884 = **$315.36**

Cost of Propane:

- 6 liters per minute of propane to maintain 2 kW output.
- Planning 7,884 hours of operation for demonstration.
- 1,131 liters per therm
- 3.83 dollars per therm

(7884 * 6 * 60) * (1.48/1131) = **$3,714.05**

13.0 Kickoff Meeting Information

This section will be completed after the Kick-Off meeting has occurred.

14.0 Status/Timeline

The contract duration is 24 months from the date of the contract award. The following table shows the planned timeline for each of the three systems to be installed under this contract.

1	Apr-04	System Development
2	May-04	System Development
3	Jun-04	System Development
4	Jul-04	System Manufacture, Draft of Initial Project Description Report
5	Aug-04	System Manufacture
6	Sep-04	Complete Manufacture of System, Site Preparation
7	Oct-04	Test and Validation
8	Nov-04	Shipping, Installation, Training
9	Dec-04	Operation Month 1
10	Jan-05	Operation Month 2, Draft of Midpoint Project Status Report
11	Feb-05	Operation Month 3, Final Midpoint Project Status Report
12	Mar-05	Operation Month 4, Scheduled Maintenance
13	Apr-05	Operation Month 5
14	May-05	Operation Month 6
15	Jun-05	Operation Month 7, Scheduled Maintenance
16	Jul-05	Operation Month 8
17	Aug-05	Operation Month 9
18	Sep-05	Operation Month 10, Schedule Maintenance
19	Oct-05	Operation Month 11
20	Nov-05	Operation Month 12
21	Dec-05	Decommission, Removal, Remediation, Draft of Final Report
22	Jan-06	Completion of Final Report
23	Feb-06	CERL Review of Final Report
24	Mar-06	Contractual End of Project

Appendix

There are no Appendix materials to be attached at this time.